

**What is Claimed Is:**

- 1                   1.       A communications system comprising:  
2                   stratospheric platform having a payload controller and a phased  
3                   array antenna having a plurality of main array antenna elements for generating a  
4                   plurality of communication beams and a plurality of auxiliary elements for  
5                   canceling interference between the communication beam;  
6                   a gateway station in communication with said stratospheric  
7                   platform, said gateway station scaling the plurality of elements to form a  
8                   plurality of beams and auxiliary element output, said gateway station  
9                   communicating a control signal to the stratospheric platform to communicate a  
10                  scaling of elements to form the communication beams and the auxiliary element  
11                  output.
- 1                   2.       A communications system as recited in claim 1, wherein  
2                   the payload controller comprises a demultiplexer for receiving control signals.
- 1                   3.       A communications system as recited in claim 2, wherein  
2                   the demultiplexer generates a plurality of element control signals.
- 1                   4.       A system as recited in claim 3, wherein the element  
2                   control signals are coupled to an RF feed, the RF feed is coupled to elements of  
3                   said phased array antenna.
- 1                   5.       A system as recited in claim 1, wherein said auxiliary  
2                   element output is a function of a direction of the plurality of the communication  
3                   beams.

1           6.     A system as recited in claim 1, wherein the gateway  
2 station comprises a plurality of multiplication gates each having a respective  
3 weight, said auxiliary element output being a function of said weight.

1           7.     A system as recited in claim 1, wherein said gateway  
2 station further comprises a multiplexer/demultiplexer.

1           8.     A system as recited in claim 7, wherein said  
2 multiplexer/demultiplexer comprises a code division multiplexer/demultiplexer.

1           9.     A system as recited in claim 1, wherein said ground  
2 station is coupled to a terrestrial network.

1           10.    A system as recited in claim 9, wherein said terrestrial  
2 network comprises the Internet.

1           11.    A system as recited in claim 9, wherein the terrestrial  
2 network comprises the public service telephone network.

1           12.    A communications system, comprising:  
2 a ground station having;  
3 a beam generator for generating a plurality of beam control  
4 signals,

5 a digital beam former circuit receiving the beam control signals  
6 and generating a plurality of first element control signals for generating  
7 communication beams and a plurality of auxiliary element control signals for  
8 canceling interference from the communication beams,

9 a multiplexer multiplexing the first element control signals, and  
10 an RF subsystem for communicating an RF signal corresponding  
11 to the first element control signals and the auxiliary element control signals;  
12 a stratospheric platform having;

13 a payload receiver for receiving the RF signals,  
14 a demultiplexer demultiplexing the RF signals into a second  
15 plurality of element control signals corresponding to the first element control  
16 signals and a second plurality of auxiliary element control signals and  
17 generating a plurality of communication beams in response to the second  
18 plurality of element control signals and a plurality of auxiliary element outputs  
19 in response to the second plurality of auxiliary element control signals.

1 13. A system as recited in claim 12, wherein said ground  
2 station comprises a gateway station.

1 14. A system as recited in claim 12, wherein said ground  
2 station is coupled to a terrestrial network.

1 15. A system as recited in claim 14, wherein said terrestrial  
2 network comprises the internet.

1 16. A system as recited in claim 15, wherein the terrestrial  
2 network comprises the public service telephone network.

1 17. A system as recited in claim 12, wherein the gateway  
2 station comprises a plurality of multiplication gates each having a respective  
3 weight, said auxiliary element output being a function of said weight.

1 18. A method of controlling a communications system  
2 having a stratospheric platform with a phased array antenna with a plurality of  
3 main array elements and a plurality of auxiliary elements, said method  
4 comprising the steps of:

5 forming a plurality of communication beams in a gateway station  
6 by scaling a plurality of elements;

7                   forming a plurality of auxiliary element outputs as a function of  
8   the plurality of the communication beams by forming auxiliary element control  
9   signals;

10                  communicating the scaling of elements and the auxiliary element  
11   control signals to a stratospheric platform; and

12                  generating the communication beams in response to the scaling  
13   of elements by the stratospheric platform; and

14                  generating the auxiliary element outputs in response to the  
15   auxiliary element control signals by the stratospheric platform.

1                  19.   A method as recited in claim 18 wherein said step of  
2   forming a plurality of auxiliary element outputs comprises the step of weighting  
3   the auxiliary element control signals.